

Dr. M.G.R. EDUCATIONAL AND RESEARCH INSTITUTE
Deemed to be University

Maduravoyal, Chennai – 600 095, Tamilnadu, India
(An ISO 2001:2018 Certified Institution)

University with Graded Autonomy Status



SYLLABUS & CURRICULUM
for
M.D. PHARMACOLOGY

2020 onwards

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M.D. PHARMACOLOGY

1. Goals

The aim of MD course in Pharmacology are:

- ❖ To train a medical postgraduate to be a Pharmacologist who is well versed with the basic principles of Pharmacology and it's applications in theory and also update with the recent advances.
- ❖ Acquisition of skills related to teaching, research methodology, industry and corporate world.
- ❖ Knowledge of elementary statistics and its applications.
- ❖ Overall development of skills and personality of the PG student.
- ❖ Broaden the scope of Pharmacology from bench to bed side.

2. Objectives

At the end of the MD course in Pharmacology, the student should be able to:

- ❖ Recognize the importance of Pharmacology as a key branch in health sciences.
- ❖ Demonstrate sound knowledge of general pharmacological principles, systemic pharmacology and clinical pharmacology.
- ❖ Plan and conduct lecture, demonstration, practical and tutorial classes for students of medical and allied disciplines.
- ❖ Carry out screening of drugs for pharmacological and toxicological profile.
- ❖ Carry out drug related literature search, formulate a research project and undertake the same. Apply appropriate statistical methods for summarizing and analyzing data.

- ❖ Present research findings in conferences (oral / poster sessions), communicate research / educational papers in peer reviewed journals, critically review and comment on research papers.
- ❖ Use computer and IT tools for teaching, research and presentation / publication of data.
- ❖ Monitor adverse drug reactions and perform a number of service activities e.g. therapeutic drug monitoring, pharmaco vigilance, pharmacoeconomics and pharmacoepidemiology
- ❖ Understand the principles of essential drug concept and rational use of drugs including rational pharmacotherapy.
- ❖ Provide drug information service to doctors / public
- ❖ Demonstrate knowledge of drug rules and regulations existing in the country.
- ❖ Be aware of the legal and ethical issues involved in drug development and research.
- ❖ Be able to constitute and conduct the proceedings of various committees e.g. IAEC, IEC, etc.
- ❖ They should also become a lifetime learner so as to be regularly updated about the advances in the field of Pharmacology.

➤ **Methods of training**

- ❖ Group discussions, Seminars, Symposia, Journal Clubs and case discussions.
- ❖ Lectures/lecture demonstrations may be arranged for selected topics in pharmacology as well as in allied disciplines.
- ❖ Every candidate during his postgraduate studies, shall actively and regularly participate in undergraduate training programme.
- ❖ Web based guest lectures.
- ❖ Animal simulation experiments.

- ❖ Clinical posting to various departments like medicine & its allied wings.
- ❖ Training in pharmacological approach to geriatric care.

SYLLABUS

Theory - The **course contents** should cover the following broad topics:

1. Basic and molecular pharmacology
2. Drug receptors and Pharmacodynamics
3. Pharmacokinetics (Absorption, Distribution, Metabolism and Excretion)
4. Biotransformation
5. Pharmacogenomics and Pharmacogenetics
6. Autonomic Pharmacology
7. Drugs acting on Smooth muscles
8. Clinical pharmacology
9. Drug development and Regulations
10. Clinical Pharmacokinetics
11. Drugs acting on Synaptic and Neuroeffector Junctional sites
12. Drugs acting on Central Nervous System (Sedative, Hypnotics, Antiepileptics, General Anesthetics, Local Anesthetics, Skeletal Muscle Relaxants, Antipsychotic, Antidepressants, Drugs used in Parkinson's disease and other neurodegenerative disorders, opioid agonists and antagonists, Drugs of abuse)
13. Drugs modifying renal function
14. Drugs acting on cardiovascular system and haemostatic mechanisms (Antihypertensives, Antianginal, Antiarrhythmics, Drugs used in heart failure, Drugs used in Dyslipidemias, Fibrinolytics, Anticoagulants, Antiplatelets)
15. Reproductive Pharmacology
16. Agents effecting calcification and bone turnover
17. Autacoids and related pharmacological agents (NSAIDs) and drugs used in Rheumatoid arthritis and Gout

18. Gastrointestinal drugs
19. Pharmacology of drugs affecting the respiratory system (drugs used in Bronchial Asthma and COPD)
20. Antimicrobial, antiparasitics, disinfectants, antiseptics
21. Chemotherapy of neoplastic disease
22. Antiviral drugs
23. Drugs used in autoimmune disorder and Graft versus Host Disease)
24. Dermatological pharmacology
25. Ocular pharmacology
26. Use of drugs in pregnancy
27. Immunomodulators - immunosuppressants and immunostimulants
28. Pharmacology of drugs used in endocrine disorders (drugs used in diabetes mellitus, hypothalamic and pituitary hormones, thyroid and antithyroid drugs, adrenocorticoid hormones and their antagonists, gonadal hormones and their inhibitors)
29. Drug delivery systems
30. Heavy metal poisoning
31. General screening and evaluation of:
 - ❖ Analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs,
 - ❖ antidepressants, antianxiety and antipsychotics, sedatives, musclerelaxants, antihypertensive, hypocholesterolaemic agents, antiarrhythmic,
 - ❖ diuretics, adrenergic blocking drugs
 - ❖ Drugs used in peptic ulcer diseases/Prokinetic agents/ antiemetics
 - ❖ Antitussives, /anti-asthma agents
 - ❖ Local Anesthetics
 - ❖ Oxytocics, antifertility agents
 - ❖ Antidiabetics

- ❖ Behavioral pharmacology models and evaluation of drugs affecting learning and memory

32. Bioassays

- ❖ Bioassay methods
- ❖ Animal experiments: Ethical considerations, ethical approval, applicable regulatory Guidelines (CPCSEA), humane animal research (principles of 3Rs) and alternatives to animal experimentation. General and statistical considerations
- ❖ Anesthetics used in laboratory animals
- ❖ Principles of EC₅₀, ED₅₀, pD₂ and pA₂ values of drugs
- ❖ Describe methods of bioassay for estimation of :Acetylcholine, skeletal neuromuscular junction blockers, adrenaline, noradrenaline, histamine, 5 HT, hormones, insulin, vasopressin/oxytocin, estrogen, progestins, ACTH.
- ❖ Competitive antagonism - pA₂ values
- ❖ Immunoassays: Concept, types of bioassays and their applications
- ❖ Animal experiments: Ethical consideration, ethical approval
- ❖ Regulatory Guidelines (CPCSEA) and alternatives to animal experimentation

33. Biochemical Pharmacology

- ❖ Basic principles and applications of simple analytical methods
- ❖ Principles of quantitative estimation of drugs, endogenous compounds and poisons using Colorimeter, Spectrophotometry, flame photometry, High Performance Liquid Chromatography (HPLC) and enzyme-linked, Immunosorbent assay (ELISA).

34. Recent advances in Pharmacology.

35. Special problems related to drug use in different age groups, Pregnancy and Disease conditions.

36. Research Methodology:
(The candidate shall get acquainted with various aspects of biomedical research, so as to enable him to undertake and supervise research projects).
- (a) Basic Principles and related aspects.
 - (b) Ethical issues related to research on human subjects and animals.
 - (c) Ethical guidelines of ICMR, INSA and Breeding and Experiments Animals (Control and Supervision) Rules 1998.
37. Perinatal and Pediatric Pharmacology
38. Geriatric Pharmacology
39. Non-metallic toxicants - air pollutants, pesticides etc.
40. Research methodology and biostatistics
41. Literature search.
42. Pharmacogenomics, Pharmacovigilance (ADR reporting),
Pharmacoeconomics (cost-effectiveness study) and pharmaco-epidemiology
43. Over the counter drugs
44. Dietary supplements and herbal medicines
45. Pharmacometrics - methods of drug evaluation.

Practicals

Objective: A candidate, after passing the M.D. Pharmacology examination should possess skills in testing the effects of drugs on the various experimental system specified below.

The candidate should also be well versed in interpreting and analysis of the observations and data obtained from studies.

A. Experiments on Laboratory Animals

1. Anaesthetized animals: Dogs, Cats., etc.

2. Small Animals: - Methods of testing for local anesthetics, Anti-inflammatory drugs, analgesics, anticonvulsants, Psychopharmacological agents, etc.,
3. Isolated tissue preparations:
 - (a) Rabbits: - Jejunum, heart
 - (b) Rats: - Colon, Uterus, Fundus of stomach, phrenic nerve-diaphragm.
 - (c) Guinea Pigs: - Ileum, tracheal chain.
 - (d) Frogs: - Rectus Muscle, Sciatic Nerve- Gastrocnemius muscle preparation.
4. Demonstration of techniques

B. Chemical Experiments

1. Simple tests for detecting the chemical nature of drugs.
2. Monitoring of drugs levels in body fluids candidates should acquaint with the techniques of monitoring drug levels, using systems like chromatography, spectrophotometry and immunoassays.

C. On Human Volunteers

Simple tests for monitoring of effect of drugs like:

1. Bronchodilators - using peak flow meters.
2. Psychopharmacological agents - Behavioral effects.
3. ECG changes

D. Computer based Animal simulation Experiments.

POSTINGS IN OTHER DEPARTMENTS

A candidate of the M.D Degree Course in Pharmacology, needs to be well versed in the applied aspects of pharmacology and therapeutics. Actual postings in the wards of the Clinical departments will help the candidate get acquainted with the patterns of drug use, rational drug therapy, adverse drug reactions and interactions etc., Such postings will also help him gain confidence in interacting

with the clinicians, which will be needed if he chooses to be a clinical pharmacologist in his future career.

The following clinical postings are recommended:

❖ General Medicine (OPD& Wards)	:	1 Month
❖ Clinical Trials In General Medicine	:	1 month
❖ Pediatrics	:	1 Month
❖ Anesthesiology& I.C.U.	:	15 days
❖ Dermatology &Psychiatry	:	15 days
❖ Pharmacovigilance	:	15 days

Total duration of clinical postings - 4 &1/2 months.

These postings shall be during the initial phase of the studies. Monitoring postings in clinical departments would be through daily discussions with the faculty during the afternoon session and as part of maintenance of work diary.

Schedule of work time table

I YEAR :

1st to 3rdmonth : Search and Identification of topic for dissertation in consultation with guide and use of library, Satellite search etc., and preparation of synopsis.

4th to 6thmonth : Study of Methodology of Experiments, Animal Lab, Maintenance of Animals, Study of Instruments for Experimentation, Analytical Chemistry. To get acquainted with methodology of clinical study & submission of synopsis to the University for registration.

7th to 10thmonth : Literature Survey, Preparation of Reference Cards, Collection of relevant literature and Journal Work. Apart from this, the students shall attend all the theory classes, Practical, Student Tutorials and other teaching activities. They should also maintain work diary and duly get it countersigned by Head of the Department.

II YEAR & III YEAR

Candidates should do all the experiments mentioned in the course content on weekly basis and also continue the experimental work of the dissertation if any, candidates should participate in seminars, Journal Clubs on weekly basis and file the seminars done to be presented as a book.

They should undergo training in teaching skills.

Deputing the Postgraduates to MEU to undergo training in TOT programme (training of trainers)

They should also maintain a daily Log Book of their work in the Department for 3 years.

MONITORING PROGRESS OF P.G STUDENTS

1. Work dairy / Log book: Every candidate shall maintain a work diary and record his/her participation in the training programme conducted by the department such as journal reviews, seminars etc. Special mention be made of the presentations made by the candidate as well as the laboratory experiments conducted.
2. The log book shall be scrutinized and certified by head of department. The department will conduct periodic tests which may include written paper, practical and viva - voce. Records and marks obtained in such tests will be maintained by head of department and sent to the university.

DISSERTATION

1. Every candidate is required to carry out work on a selected research project under the guidance of a recognized postgraduate teacher. The results of such work shall be submitted in the form of a dissertation
2. The dissertation is aimed to train the candidate in pharmacological research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of relevant literature, getting acquainted with recent advances, designing of research study, collection of data, critical analysis of results and drawing conclusions.

3. The dissertation is to be submitted at least six months before the final examination as notified by the university to the Registrar (Evaluation).
4. The dissertation shall be evaluated by three reviewers. Prior acceptance of the dissertation shall be a precondition for a candidate to appear for the final examination

TEACHING LEARNING ACTIVITIES

1.	Post-graduate seminar	Weekly
2.	Post-graduate Journal criticism	Weekly
3.	Protocol writing	Weekly
4.	Clinical Case discussion	Biweekly
5.	Pharmacokinetic problem discussion	Biweekly
6.	Animal Technique Demonstrations	Monthly
7.	Use of Computer simulated animal Techniques	Monthly
8.	Clinical postings to various departments of Hospital	4 ½ months
9.	Integrated teaching for both UGs and PGs	Intermittently throughout the course

ATTENDANCE : All the candidates joining the Post Graduate training programme shall work as ‘Full Time Residents’ during the period of training and shall attend not less than 80% (Eighty percent) of the imparted training during each academic year including assignments, assessed full time responsibilities and participation in all facets of the educational process.

Presentation & Publication : A postgraduate student of a postgraduate degree course in broad specialties/super specialties would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination

ASSESSMENT

FORMATIVE ASSESSMENT i.e., assessment during the training

Formative assessment will be continual and assess medical knowledge, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

General Principles

Internal Assessment held periodic, covering all domains of learning and used to provide feedback to improve learning; it also cover professionalism and communication skills. The Internal Assessment will be conducted in theory and practical/clinical examination.

Quarterly assessment during the MD training will be based on

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities /CMEs

The student will be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I)

ANNEXURE 1

POSTGRADUATE STUDENTS APPRAISAL FORM

DEPARTMENT OF PHARMACOLOGY

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	Particulars	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1.	Journal based / recent advances learning				
2.	Laboratory or Skill based learning				
3.	Self directed learning and teaching				
4.	Departmental and interdepartmental learning activity				
5.	External and Outreach Activities / CMEs				
6.	Thesis / Research work				
7.	Log Book Maintenance				

Publications

Yes/No

Remarks*

***REMARKS:** Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation is suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HOD

SUMMATIVE ASSESSMENT, ie., assessment at the end of training

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The post graduate examination shall be in three parts:

1. Thesis

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory examination:

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D./ MS shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

3. Practical/clinical and Oral/viva voce examination

A. Theory written Examination

There shall be four question papers, each of three hours duration. Each paper shall consist of 10 short essay questions carrying 10 marks each. Total marks for each paper will be 100.

Paper I = 100 Marks

Paper II = 100 Marks

Paper III = 100 Marks

Paper IV = 100 Marks

Total	400 Marks
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Paper I : General Pharmacology

Paper II : Clinical Pharmacology

Paper III : Systemic Pharmacology

Paper IV : Recent Advances in Pharmacology

** The topics assigned to the different papers are generally evaluated under those sections. However, a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.*

B. Practical / Clinical Examination & Viva Voce (Total 300 marks)

Practical Examination **200 Marks**

Practicals are to be held on 2 days, along with Viva-Voce.

Experimental Pharmacology

1. Blood pressure, respiratory and any other possible recordings on anaesthetized animal: rat/rabbit/guinea pig/dog.

or

Bioassay: 3 or 4-point assay using various isolated tissues like frog rectus, rat uterus, guinea pig ileum, rabbit duodenum etc. **- 40 Marks**

2. Interpretation of Graphs

Eg: (i) Recordings of– BP/ RS/ GIT for dog/cat &

(ii) Tracings of Bioassay

- 20 Marks

3. Demonstration of Technique

Demonstrations of any one technique using small animals – rat/mice/rabbit, depending on the availability of equipment.

Eg: Anti-inflammatory drugs/Straub's tail test/Anti-convulsants/ Analgesics/ Barbiturate sleeping time/ Hebb William's Maze

- 20 Marks

4. Chemical Testing

Identification of any one substance by chemical testing for Alkaloids/ Glycosides/ Local Anesthetics/ Iodides/ Steroids/ Blood sugar estimation/ Urine sample for substance of abuse using spectrophotometer/calorimeter etc

- 20 Marks

Clinical Pharmacology

1. **Clinical Problems** – Rationality/ Appropriateness/ Correctness in Prescribing using a Clinical Case or a Simulated paper case. **- 30 Marks**

2. Clinical Trial Protocol Writing **20 Marks**

3. PK calculations **15 Marks**

4. Critical evaluation of reviewed/ published article in Clinical Pharmacology **15 Marks**

5. ADR reporting and causality assessment **20 Marks**

C. VIVA VOCE **100 Marks**

1) Viva-Voce Examination (80 Marks)

Students will be examined by all the examiners together about students' knowledge and comprehension of the prescribed course contents, analytical approach, expression and interpretation of data It includes discussion on dissertation.

2) Pedagogy Exercise (20 Marks)

A topic be given to each candidate along with the Practical Examination question paper on the first day. Student is asked to make a presentation on the topic on the second day for 8 to 10 minutes.

Maximum marks for M.D. Pharmacology	Theory	Practical & Viva	Grand Total
	400	300 (Practical – 200 & Viva – 100)	700

MARKS QUALIFYING FOR A PASS

Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degree examination. Obtaining of 50% marks in Practical examination shall be mandatory for passing the examination as a whole in the degree examination.

Recommended Reading Material

Books (latest edition)

1. Goodman & Gilman's The Pharmacological Basis of Therapeutics, ed. Laurence Brunton, Bruce A. Chabner, Bjorn Knollman.
2. Essentials of Medical Pharmacology, by KD Tripathi
3. Basic and Clinical Pharmacology, by Bertram G. Katzung and Anthony J. Trevor
4. Drug Discovery and Evaluation: Pharmacological Assays Editors: Vogel, Hans Clinical Pharmacology by Laurence, Bennett and Brown
6. Rang and Dale's Pharmacology by H.P. Rang
7. Koda Kimble and Youngs Applied Therapeutics by Brian K Allredge and Robin L Corelli

M.D. DEGREE EXAMINATION-MODEL PAPER

[Time:3Hours]

[Max. Marks:100]

BASIC AND GENERAL PHARMACOLOGY

PAPER –I

Your answers should be specific to the questions asked.

Draw neat labeled diagrams wherever necessary. Answer all questions

SHORT ESSAY

(10 x 10 =100 marks)

1. Discuss the biotransformation of drugs with examples
2. Describe the various types of drug transport and briefly explain the factors modifying drug absorption
3. Novel drug delivery system
4. Student's test
5. Ion channels
6. Principles of management of drug poisoning
7. Write briefly about the use of drugs in pregnancy and lactation
8. Discuss the principles of drug action
9. Drugs in Geriatrics
10. Teratogenesis

M.D. DEGREE EXAMINATION – MODEL PAPER

[Time:3Hours]

[Max. Marks:100]

SYSTEMIC PHARMACOLOGY - I

PAPER – II

Your answers should be specific to the questions asked.
Draw neat labeled diagrams wherever necessary. Answer all questions

SHORT ESSAY

10 X 10=100 Marks

1. Discuss the current concepts in the Pharmacotherapy of hypertension
2. Discuss the drug treatment of Alzheimer diseases.
3. Balanced anaesthesia
4. Preclinical evaluation of anti-peptic ulcer drugs.
5. Plasma expanders
6. Opioid antagonists
7. Discuss the clinical uses of heparin
8. Phosphodiesterase inhibitors.
9. Recent advances in treatment of CHF
10. Nitric oxide pharmacology

M.D. DEGREE EXAMINATION-MODEL PAPER

[Time: 3 Hours]

[Max. Marks:100]

SYSTEMIC PHARMACOLOGY - II

PAPER – III

Your answers should be specific to the questions asked.
Draw neat labeled diagrams wherever necessary. Answer all questions

SHORT ESSAY

10 X10 =100 Marks

1. Enumerate corticosteroid preparations. Discuss the pharmacology of glucocorticoids
2. Discuss in detail the drugs used in gram negative bacterial infections
3. Gliptins
4. Teicoplanin
5. Isoxsuprine
6. Toxicity ameliorating agents in cancer chemotherapy
7. Tacrolimus
8. Echinocandins
9. Post exposure prophylaxis of HIV
10. Albendazole

M.D. DEGREE EXAMINATION – MODEL PAPER

[Time:3Hours]

[Max. Marks:100]

CLINICAL PHARMACOLOGY

PAPER – IV

Your answers should be specific to the questions asked.

Draw neat labeled diagrams wherever necessary. Answer all questions

SHORT ESSAY

10 X10 =100 Marks

1. Discuss the pharmacotherapy and recent advances in congestive heart failure
2. Describe the clinical pharmacology and therapeutic uses of phenytoin
3. Phase – III clinical trials
4. Informed consent
5. Methods of evaluate antidiabetic drugs
6. Retrospective study
7. Chronopharmacology
8. Therapeutic jungle
9. Biosimilars
10. High throughput screening